editions of :—" Electricity in its Application to Telegraphy," by T. E. Herbert; " Central Station Electricity Supply," by A. Gay and C. H. Yeaman: " The Alternating-Current Circuit and Motor," by W. P. Maycock; and " Radium," by S. R. Bottone.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—An Arnold Gerstenberg studentship will be offered for competition in the Michaelmas term of 1906. The studentship will be awarded by means of essays. Every candidate must send on or before October 1, 1906, an essay on one of the subjects printed below addressed to Dr. James Ward, Trinity College. The studentship, which will be of the annual value of nearly 90*l.*, will be tenable for two years, upon the condition that at the end of the first year the student's progress in philosophical study is deemed satisfactory by the board of managers. The subjects for essays are :—(1) a philosophical discussion of the doctrine of energy and particularly of the new theory of energetics; (2) a critical examination of Descartes' philosophy of nature; (3) the relation of mathematics and the theory of probability to physics; (4) the theory of psychophysical parallelism; (5) the scope and methods of comparative psychology; (6) the philosophical import of post-Darwinian theories of natural selection.

The principal and the professors at McGill University, Montreal have nominated Mr. L. V. King, a student in the faculty of arts, to the Canadian scholarship lately established at Christ's College.

An exhibition of 50*l.* a year tenable for two years is offered by the governing body of Emmanuel College to an advanced student commencing residence at the college in October, 1905. Applications should be sent to the master of Emmanuel (from whom further particulars may be obtained) not later than October 1.

The local examinations and lectures syndicate is about to elect an assistant secretary for the department of the local lectures. The appointment will be in the first instance for one year. The stipend will be 150*l.* in an ordinary year, and 200*l.* in those years in which summer meetings are held. Graduates of the university who desire to offer themselves as candidates are requested to send their names before May 8 to the Rev. D. H. S. Cranage.

THE London School of Tropical Medicine has been admitted as a school of the University of London in the faculty of medicine in tropical medicine only.

The committee of the Liverpool School of Tropical Medicine has appointed Mr. R. T. Newstead lecturer in economic entomology and parasitology.

THE fourth annual students' soirée of the Sir John Cass Technical Institute will be held in the institute, Jewry Street, Aldgate, E.C., on Saturday, March 18. Exhibits and demonstrations referring to the work of the various departments form part of the programme.

IT is reported, says *Science*, that Mr. Andrew Carnegie has offered to give 100,000*l.* to the University of Virginia on the condition that the authorities of the institution raise a similar amount from other sources, and that the late James C. Carter, the eminent New York lawyer, has bequeathed 40,000*l.* to Harvard University. *Science* also states that at the first of the winter convocations of the George Washington University a gift of property, estimated to be worth 20,000*l.*, was announced for the establishment of a chair and course of graduate study on the history of civilisation. Various sums of money raised by the trustees and alumni association, aggregating 55,000*l.*, were also announced.

A COMMISSION was appointed a few years ago to inquire into the condition of manual and practical instruction in Irish primary schools, and, as the result of the recommendations made by this Commission, instruction in elementary experimental science was introduced into the primary schools of Ireland. The results of this teaching have, in the opinion of competent authorities, been in every way satisfactory. Not only has the educational value of experimental science again been demonstrated, but its beneficial effects on the progress of Ireland's industries and agriculture have been made clear. Notwithstanding the success which naturally has followed the introduction of practical instruction in scientific principles into Irish elementary schools, the Treasury has refused to renew the small grant required to meet the necessary expenditure, and the work of organising science instruction in the schools—after four years—is being stopped. It is difficult indeed to understand so retrograde a policy. The incompleteness of all schemes of education which ignore the claims of practical instruction in the fundamental facts of science has been demonstrated repeatedly; the connection between American and German industrial success and the scientific systems of education established in these countries has become familiar to all interested in their country's welfare, so that no excuse—not even the urgent need of economy in national expenditure—can justify this action of the Treasury. It is to be hoped earnestly that steps may yet be taken to avert what would be nothing short of a calamity to Ireland, and that the work, which has begun so auspiciously under the present organisers of science instruction, instead of being stopped may be broadened and extended.

IT is stated in the *Times* that the committee, presided over by Mr. Haldane, M.P., appointed to consider the allocation of the increased grant-in-aid of education of a university standard in arts and science has now finished its inquiry. Excluding 9000*l.* to be allotted later in the financial year, the committee proposes that the sum of 45,000*l.* (making a total grant of 54,000*l.*) be allotted as follows :—Manchester, 6000*l.*; University College, London, 5000*l.*; Liverpool, 5000*l.*; Birmingham, 4500*l.*; Leeds, 4000*l.*; King's College, London, 3900*l.*; Newcastle-on-Tyne, 3000*l.*; Nottingham, 2900*l.*; Sheffield, 2300*l.*; Bedford College, London, 2000*l.*; Bristol, 2000*l.*; Reading, 1700*l.*; Southampton, 1700*l.*; Dundee, 1000*l.* The committee expresses the view that the time has come for making a new departure in the principle on which State assistance is to be given to the highest education. It is recommended that a moderate sum should be set aside for distribution by way of payment to post-graduate students from the university colleges who devote themselves for one, two, or three years to special problems; and that to ensure the money being applied most efficiently to the stimulation of individual study, as distinguished from the general purposes of the college to the development of which other sums out of the grant are directed, the distribution should assume the form of a grant made directly to the student on the advice of some impartial authority. It is also suggested that the grant-in-aid should in future be made to a committee, instead of to the colleges direct, and that this committee should make an annual report to the Treasury, to be laid before Parliament. In conclusion the committee urges the necessity of leaving to the advisory committee discretion to deal with particular circumstances as they arise.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 9.—" On the Stellar Line near λ 4686." By Sir Norman **Lockyer**, K.C.B., F.R.S., and F. E. **Baxandall**, A.R.C.Sc.

In this paper the authors direct attention to a well-marked line of unknown origin which appears in one of the Kensington photographs of the helium spectrum near λ 4686.

It is shown that a conspicuous line near the same wave-length occurs in the spectra of the chromosphere, nebulæ, bright-line stars, certain Orion stars, and in ζ Puppis, the star the spectrum of which was found by Prof. Pickering to contain a new series of lines which he considered to belong to hydrogen.

The mean wave-length of the stellar line, as derived from the available published records, is shown to agree very closely with the wave-length of the line in the laboratory spectrum, and the authors conclude that the identity of the two lines is probably a real one.

Rydberg has shown that the line near λ 4686 is the first line in the principal series of hydrogen, and the authors of the present paper consider that the " strange " line in

the helium spectrum is probably none other than the same line. They can, however, assign no reason for its appearance in only one of the numerous photographs of the helium spectrum taken at Kensington.

"Note on the Spectrum of μ Centauri." By Sir Norman **Lockyer**, K.C.B., F.R.S., and F. E. **Baxandall**, A.R.C.Sc.

In this note the authors give an analysis of some of the bright lines in the spectrum of μ Centauri. This star not being available at Kensington, an excellent reproduction by Prof. Pickering was used as a basis for the analysis.

The chief bright lines belong to hydrogen, as Pickering and other observers have pointed out. The minor bright lines, however, have hitherto had no origin suggested for them. In this note it is shown that the most marked of the minor bright lines agree very closely in position with the strongest enhanced lines of iron, and the authors conclude that the stellar and terrestrial lines are probably identical in origin. It is pointed out that the same lines are conspicuous in the spectra of Novæ in their earlier stages.

"The Arc Spectrum of Scandium and its Relation to Celestial Spectra." By Sir Norman **Lockyer**, K.C.B., F.R.S., and F. E. **Baxandall**, A.R.C.Sc.

In this paper a record is given of the lines in the arc spectrum of the rare element scandium between λ 3900 and λ 5720. The photograph used for reduction was taken with a large Rowland concave grating, having a ruled surface of $5\frac{3}{4} \times 2$ inches ($14\frac{1}{2} \times 5$ cm.) and a radius of 21 feet 6 inches. The scale of the photograph is such that the distance between K and D is $30\frac{1}{4}$ inches, or 77 cm. This is equivalent to 2·6 tenth-metres per millimetre.

An analysis of the lines is given with regard to their appearance in the Fraunhoferic spectrum. It is shown that nearly all the stronger lines occur as solar lines, but the great majority of the lines weaker than intensity 6 (maximum intensity 10) are missing from the solar spectrum.

Short analyses are also given of the relation of the scandium arc lines to the lines in the spectra of the chromosphere, sun-spots, and stars. The strongest scandium lines are shown to be specially prominent in the chromospheric spectrum, the same lines being conspicuous in stellar spectra of the Polarian type (*e.g.* γ Cygni). In the higher stellar type Cygnian (α Cygni), the strongest scandium lines are present, but only weak. At the still higher stages of stellar spectra the scandium lines are lacking.

With regard to sun-spot spectra, the only solar-scandium line (λ 5672·047) given by Rowland in the region F to D, is found to be nearly always well affected, and it often occurs amongst the twelve most widened lines recorded at Kensington in spot spectra.

"On Europium and its Ultra-violet Spectrum": Sir William **Crookes**, F.R.S.

Exner and Haschek have measured the wave-lengths of the europium lines[1] from material supplied by Demarçay. A comparison of their lines with the present author's shows that the material was by no means pure. Urbain's europia is not quite so free from impurities as his gadolinia. The author has been able to detect in his photographs the following lines:—Gadolinium is represented by very faint lines at 3450·55, 3481·99, 3585·10, 3646·36, 3654·79, 3656·32, 3664·76, 3697·90, 3699·89, 3743·62, 3768·52, 3796·58, 3805·70, 3850·83, 3851·16, 4050·08, 4225·33. Yttrium is represented by the line at 3774·51, lanthanum by the line at 3988.66, and calcium by the two lines at 3933.825 and 3968.625.

February 9 and February 23.—"Phosphorescence caused by the Beta and Gamma Rays of Radium." By G. T. **Beilby**. Communicated by Prof. Larmor, Sec. R.S. Part i. read February 9, part ii. read February 23.

The conclusions arrived at in these papers may be summarised as follows:—

(1) Certain types of phosphorescence are due to the molecular movement or displacement which is produced by heat, by mechanical stresses, or by radiant energy.

(2) Certain other types are distinguished by their appearance in three stages, called here primary, secondary, and revived phosphorescence. These can be explained as due to atomic changes in which chemical affinity is the controlling factor.

(3) The phenomena of this type appear to support the view that a species of electrolysis occurs in solids exposed to the β or kathode rays; that the products of electrolysis are insulated from each other, as in a viscous electrolyte; and that it is the breaking down of this insulation with the re-combination of the ions which causes revived phosphorescence.

When the canary-yellow crystals of barium platinocyanide are exposed to the β and γ rays for some hours, they turn red, and their phosphorescence in the rays falls to 8 per cent. of its original value. Neither the colour nor the phosphorescence is restored by exposure to sunlight or to diffused daylight. The only way completely to restore these qualities is to dissolve the salt in water and re-crystallise it. In this way the reddened salt is completely re-converted into the yellow form, and there are no signs that the reddening has been associated with any permanent chemical change. The possible physical changes were, therefore, investigated. When the crystalline structure of the yellow salt is impaired, either by mechanical flowing or by dehydration by heat, there is a very conspicuous colour change, the canary-yellow giving place to an intense brick-red colour, while the phosphorescence in the radium rays falls to 2 per cent. of its original value. By solution and crystallisation these amorphous forms are restored to the yellow crystalline state with its full phosphorescent value. The effects produced by the β rays are, therefore, closely analogous to those produced by the change from the crystalline to the amorphous state. In the light of the author's earlier observations on the phase changes $A \rightleftarrows C$ in metals and salts, it was to be expected that the change $C \rightarrow A$, produced by mechanical flow, would be reversed by raising the temperature of the substance to the stability point of the A phase. Making due allowance for the difficulty caused by the presence of water of crystallisation and its partial loss on heating the salt, it was found that the change $A \rightarrow C$ could be brought about in the mechanically-flowed salt at a temperature of about 90°, the colour being thereby changed from red to yellow, and the phosphorescence raised from 2 per cent. to 33 per cent. of its original value. It was found that the crystals reddened by the rays could also be partially restored to their former condition of colour and phosphorescence by quickly heating them in a sealed capillary tube to about 120°. By this treatment the phosphorescence was raised from 8 per cent. to 33 per cent, of its original value in the yellow crystals. The analogy between the phase changes caused by mechanical flow and the change which results from exposure to the β rays is thus complete, and it is concluded that the over-stimulation to which the vibrating molecules of the platinocyanide crystals are subjected under the action of the β rays during the preliminary stage of bright phosphorescence results in a state analogous to that of elastic fatigue in vibrating metal wires or glass fibres. Up to a certain point, this fatigue may be recovered from, that is to say, if the relative displacement of the molecules from their proper crystalline relations has not passed beyond a certain stage; but beyond this stage there is no power of self-recovery, and heat is necessary to endow the molecules with freedom of movement sufficient to enable them to return to their crystalline positions. The final stage of permanent fatigue or over-strain in the salt corresponds with the amorphous condition, which results from mechanically-produced flow. The comparative instability of the crystalline structure in this salt has thus been the means of directing attention to the part which may be played by physical structure in phosphorescence. But the persistence of phosphorescence, even in the amorphous state, gives an equally clear indication that a more general explanation of these phenomena is still needed.

This further explanation was reached by a study of the action of the β and γ rays on quartz, glass, calcspar, and the haloid salts of potassium. In these substances, in addition to a primary phosphorescence, the rays produce certain well-marked coloration effects; quartz is turned brown, calcspar faint yellow, glass purple or brown, potassium chloride reddish-violet, and bromide and iodide blue to green. Further, whether the coloration lasts for months or only for a few moments, it is found that phosphor-

[1] "Wellenlängen-Tabellen für Spektralanalytische Untersuchungen," F. Deuticke. (Leipzig and Vienna, 1902.)

escence is revived when the substance is heated, while the colour fades or disappears. In quartz, glass, and calcspar it is easy to locate the seat of phosphorescence within the layers which have been penetrated and coloured by the rays. This penetration may take place to the depth of several millimetres, and in materials like quartz, glass, or calcspar it is certain that whatever changes occur in these layers must be chemically self-contained and quite removed from atmospheric influences. The view, therefore, that coloration is due to the reduction of one of the elements of the substance, *e.g.* potassium in glass, affords only a partial explanation of the phenomena. It is necessary to suppose that the separation and retention of the metal ions must equally involve the separation and retention of the ions of the acid radicle with which the metal had been combined. Further, in order that the different ions may be kept apart, the unaltered molecules must act as barriers or insulators to prevent their re-combination. But the molecules are not always immovable barriers, for, as the temperature is raised, their mobility is increased, and their insulating power is correspondingly diminished. Experiments were made on the storage of latent phosphorescing power at all temperatures between $-100°$ and $+300°$. While for each substance there is a range of temperature over which its storage capacity is at a maximum, yet the range over which storage can take place is sometimes very wide. In calcspar, storage occurs over the whole range investigated, while in crystallised platinocyanide of barium it was only observed between $-100°$ and $-50°$.

February 16.—"Polarised Röntgen Radiation." By Dr. Charles G. **Barkla.** Communicated by Prof. J. J. Thomson, F.R.S.

Experiments on secondary radiation from gases and light solids subject to X-rays led to the theory that during the passage of Röntgen radiation through such substances each electron has its motion accelerated by the intense electric fields in the primary pulses, and consequently is the origin of a secondary radiation which is most intense in the direction perpendicular to that of acceleration of the electron, and vanishes in the direction of that acceleration. The direction of electric intensity at a point in a secondary pulse is perpendicular to the line joining that point and the origin of the pulse, and is in the plane passing through the direction of acceleration of the electron.

A secondary beam the direction of propagation of which is perpendicular to that of the primary will, according to this theory, be plane polarised, the direction of electric intensity being parallel to the pulse front in the primary beam. If the primary beam be plane polarised, the secondary radiation from the electrons has a maximum intensity in a direction perpendicular to that of electric displacement in the primary beam, and zero intensity in the direction of electric displacement.

In these experiments the secondary radiation from light substances was too feeble to allow accurate measurement of the intensity of the tertiary radiation.

A consideration of the method of production of primary Röntgen rays in an X-ray tube, however, leads one to expect partial polarisation of the primary beam proceeding from the antikathode in a direction perpendicular to that of propagation of the impinging kathode rays, for there is probably at the antikathode a greater acceleration along the line of propagation of the kathode rays than in a direction at right angles; consequently, in a beam of X-rays proceeding in a direction perpendicular to that of the kathode stream, there should be greater electric intensity parallel to the stream than in a direction at right angles.

Using such a beam as the primary radiation, and a light substance, as air, paper, or aluminium, as the radiator, the intensity of a secondary beam as indicated by an electroscope was found to reach a maximum when the direction of the kathode stream was perpendicular to that of propagation of the secondary beam, and a minimum when these two were parallel.

A number of experiments made this evidence of partial polarisation of the primary radiation conclusive.

When heavier metals, such as copper, tin, and lead, which emit a secondary radiation differing considerably in character from the primary producing it, were used as the radiators, no variation in intensity of secondary radiation was observed as the bulb was rotated, though experiments were made with primary radiations varying considerably in penetrating power.

Geological Society, February 17.—Dr. J. E. Marr, F.R.S., president, in the chair.—Annual general meeting.—In his anniversary address, the president directed attention to the classification of the sedimentary rocks, pointing out that the arrangement of the events which, taken together, constitute earth-history, according to their proper sequence in time must ever remain the territory of the geologist in which he will pursue his labours by exclusively-geological methods. He pointed out that, since the time of William Smith, and mainly by the adoption of his principles, the classification of the strata had progressed towards perfection by the method of successive approximations. He directed attention to the many similarities between the records of the geological column and the records preserved in the "meteorograms" of meteorologists. In each case the records were impressed as zigzag and broken lines, though an additional difficulty occurred in the case of the geological records owing to their frequently-blurred nature. Further, the meteorologist had his chronometer, whereas the geologist must construct his time-scale from the records on what might, for purposes of comparison, be referred to as the "geograms," or strips of the geological sediments. In some cases the lines of the geograms closely coincided with time-lines, in other cases they departed therefrom more or less widely, and it was one of the tasks of the geologists, from study of the geograms, to attempt to draw in the time-lines. It was to be remembered, however, that however closely the time-lines and lines of the records coincided, they were not the same lines. The principal variations in the records of the geograms are due to alternate formation and cessation of deposit; to the differences in character of the deposits owing to various local conditions; to accumulation of contemporaneous volcanic material; to variations in the nature of the earth-movements; to changes in the nature of the included organisms; and lastly to climatic changes, and proceeded to consider the significance of these records as bearing upon the classification of the sediments. The president advocated the adoption of a triple classification, such as had been already tacitly adopted in the case of some of the sediments, as, for instance, those of Jurassic age, where divisions were made according to (1) lithological change, (2) organic change, and (3) time; and pointed out how such a classification could be adopted without any violent changes in an existing nomenclature or in the rules of priority. He illustrated the suggested changes by a more detailed discussion of the classification of the Ordovician strata, and pointed out that we had names which might be used with chronological significance in the case of the divisions of the rocks of most of the great systems; and maintained that, as our knowledge increased, we could refer beds of new areas to their places among the different series, marking periods of time with a confidence similar to that with which we have long assigned strata of remote regions to one or other of the great systems.

February 22.—Dr. J. E. Marr, F.R.S., president, in the chair.—Exhibition of a series of Danish rocks illustrating (1) the share that Echinoderms may take in rock-building; (2) the transition from the Secondary to the Tertiary Era in the Baltic basin near Denmark; (3) the special conditions at the close of the Glacial Period, in the limited area where alone these rocks are now found as erratic blocks: Dr. F. A. **Bather.**—On the order of succession of the Manx slates in their northern half, and its bearing on the origin of the schistose breccia associated therewith: Rev. J. F. **Blake.**—On the wash-outs in the Middle Coal-measures of south Yorkshire: F. E. **Middleton.** The opinion of the author is that the wash-outs occupy the sites of winding streams, meandering through the alluvial tracts in which the coal-seams were being formed.

Zoological Society, February 21 — Mr. Howard Saunders, vice-president, in the chair.—A contribution to our knowledge of the varieties of *Lacerta muralis* in western Europe and North Africa: G. A. **Boulenger.**—The Nigerian giraffe (*Giraffa camelopardalis peralta*) and the Kilimanjaro Giraffe (*G. camelopardalis tippelskirchi*): R. **Lydekker.**—Dolphins from Travancore: R. **Lydekker.** In this paper the author made special reference to two specimens of the genus

Tursiops, drawings and particulars of which had been supplied to him from the Trevandrum Museum.—A second collection of mammals made by Mr. C. H. B. Grant for Mr. C. D. Rudd's exploration of South Africa: Oldfield **Thomas** and Harold **Schwann.** The collection, which has been presented to the National Museum by Mr. Rudd, was made in the Wakkerstroom district of the South-eastern Transvaal, and includes examples of twenty-six species. Several local subspecies were described, besides a new shrew from Zululand.—The greater kudu of Somaliland: R. I. **Pocock.** The author pointed out that the northern form of *Strepsiceros strepsiceros* differed from the southern in having only about five white stripes instead of nine or ten on each side of the body. The northern form should thus rank as a distinct subspecies, for which the name *chora* was available. The difference in coloration seemed to be correlated with a difference of habitat, the northern form frequenting more mountainous and less thickly-wooded country than the southern, which was frequently found in the thick jungle along river-banks as well as in the hills.

Anthropological Institute, February 28.—Prof. W. Gowland, president, in the chair.—Group marriage, with especial reference to Australia: N. W. **Thomas.** In the course of his remarks the author pointed out that the theories of Lewis Morgan were without sufficient basis. In the place of Lewis Morgan's fifteen stages, later theorists had postulated first a period of promiscuity, and following on that group marriage, so-called, which in Australia is only now being transformed into individual marriage. But here too no sufficient account had been given of the causes which led to the abolition of promiscuity. The grounds on which it was assumed that promiscuity and group marriage were stages in human development were first philological and secondly sociological. The philological grounds were shown in the paper to be wholly insufficient, and the facts of present-day Australian life to be susceptible of other explanations.

Chemical Society, March 2.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The relation between natural and synthetical glycerylphosphoric acids: F. B. **Power** and F. **Tutin.** The authors have shown that the discrepancies of statement respecting the properties of the glycerylphosphates are due to contamination with salts of the di-ester. They have prepared and analysed a number of these salts in pure condition. Proof is also adduced that the conclusions of Willstätter and Lüdecke that the differences between the salts of natural (derived from lecithin) and artificial glycerylphosphoric acids are not those existing between mere optical isomerides are not justified.—The transmutation of geometrical isomerides: A. W. **Stewart.** The author assumes as a phase of the reaction the formation and disruption of a tetramethylene compound, which in the case of fumaric and maleic acids would be tetramethylene-1 : 2 : 3 : 4-tetracarboxylic acid, and this by disruption in two different directions would give rise to either fumaric or maleic derivatives. Illustrations of the applicability of this explanation to other cases are also given.—Linin: J. S. **Hills** and W. P. **Wynne.** Linin, $C_{23}H_{24}O_9$, a crystalline substance obtained by hydrolysis of a glucoside present in *Linum catharticum*, melts at 203°, contains four methoxyl groups, and is physiologically inactive.—The constitution of phenylmethylacridol: J. J. **Dobbie.** Hantzsch's view that the substance formed when phenylacridine methiodide is treated with an alkali is a carbinol is confirmed by the fact that the absorption spectra are different from those of the parent methiodide, and similar to those of dihydrophenylacridine.—The ultra-violet absorption spectra of certain diazo-compounds in relation to their constitution: J. J. **Dobbie** and C. K. **Tinkler.**—The latent heat of evaporation of benzene and some other compounds: J. C. **Brown.**—The reduction of *iso*phthalic acid: W. H. **Perkin,** jun., and S. S. **Pickles.** When *iso*phthalic acid is reduced with sodium amalgam at 45° it yields two tetrahydro-acids, Δ^2 and *cis*-Δ^5, and from these two others may be obtained, so that the four possible tetrahydro*iso*-phthalic acids have now been prepared. The properties and reactions of these are described.—The influence of temperature on the interaction between acetylthiocyanate and certain bases. Thiocarbamides, including carboxy-aromatic groups: the late R. E. **Doran** (compiled by A. E. Dixon).—The influence of solvents on the rotation of optically active compounds. Part viii. Ethyl tartrate in chloroform: T. S. **Patterson.**—A further note on the addition of sodium hydrogen sulphite to ketonic compounds: A. W. **Stewart.**—Action of hydrogen peroxide on carbohydrates in presence of ferrous sulphate: R. S. **Morrell** and A. E. **Bellars.** In this work attempts have been made to trace the disappearance of different sugars by optical measurements during oxidation, and from the initial and final reducing powers of the solutions. The simpler acids, formic and oxalic, resulting from the oxidation, were detected, but the more important keto-acids could not be isolated, though evidence of their presence was obtained.—Studies in chlorination. The chlorination of the isomeric chloronitrobenzenes: J. B. **Cohen** and H. G. **Bennett.** It is shown that when the first two hydrogen atoms of benzene or toluene have been substituted either by two chlorine atoms or by one chlorine atom and one nitro-group the positions occupied by subsequent chlorine atoms or nitro-groups are the same.

Linnean Society, March 2.—Prof. W. A. Herdman, F.R.S., president, in the chair.—The Ashe-Finlayson "Comparascope": D. **Finlayson.** The instrument displays two objects in the same magnified field, this being attained by a secondary stage and objective at right-angles to the primary instrument, the rays being transmitted up the body of the microscope through a right-angled prism, and clearness of the two images preserved by means of a diaphragm placed longitudinally in the microscope-tube.—Zoological nomenclature: international rules and others: Rev. T. R. R. **Stebbing.** The author's paper, introductory to a discussion, insisted on the paramount importance of obtaining agreement among zoologists on this subject. Incidentally, Mr. Stebbing ventured to ask whether there were not many rules of nomenclature on which it would be satisfactory and advisable for zoologists not only to agree among themselves, but also to come to terms with their botanical colleagues. In this regard he offered some remarks in favour of adopting the year 1751 and the "Philosophia Botanica" as starting-point and basis for what might be called the Linnean era. A section of the paper was devoted to the "Nomenclator Entomologicus" of F. Weber, published in 1795, with the object of showing that the generic names in that catalogue are without value in questions of priority. While consigning various smaller details to an appendix, the body of the paper concluded with a proposal to get rid of tautonymy (as in *Trutta trutta, Apus* (*Apus*) *apus,* or other comical arrangements) by a plan distinguishing what was legal in the past from what is to be legal in the future.—Biscayan plankton collected by H.M.S. *Research* in 1901, part ii., Thaliacea: Dr. G. Herbert **Fowler.**

Mathematical Society, March 9.—Prof. Forsyth, president, and temporarily Dr. Hobson, in the chair.—The following papers were communicated:—On the projection of two triangles on to the same triangle: Prof. M. J. M. **Hill,** Dr. L. N. G. **Filon,** and Mr. H. W. **Chapman.** A construction is given for projecting two given triangles on to the same third triangle when the plane of the latter is given, and this construction makes it possible to determine the projective relation between two planes when four points in the one and the four corresponding points in the other are given. The lines joining corresponding vertices of the two given triangles are generators of one system of a regulus, and the possible points of projection when both are projected on to the same triangle lie on a generator of the other system. As this line describes the regulus, the locus of the point in the plane of the second triangle which corresponds to a given point in the plane of the first triangle is a cubic curve with a double point. A construction for the points of the cubic is obtained.—The Weddle quartic surface: H. **Bateman.** The surface is the locus of pairs of points which are conjugate with regard to all quadrics passing through six given points. Any chord of the twisted cubic which passes through the six given points is cut harmonically by the surface. This result leads to a parametric representation of the points of the surface. The reciprocal of the surface belongs to a family of surfaces, described by Darboux, which possess conjugate systems of plane curves.—On the complete reduction of any transitive permutation group, and on the arithmetical nature of the

coefficients in its irreducible components: Prof. W. **Burnside.** The first part of the paper contains a determination of the number of times that any given irreducible component occurs, when any representation of a group of finite order as a transitive permutation group is completely reduced. The second part of the paper is occupied with the actual reduction of the permutation group. The reduction takes two forms according as the domain of rationality is defined by the characteristics, or by the roots of unity of which the characteristics are functions.—On the theory of the logarithmic potential: Prof. T. J. I'A. **Bromwich.** The paper is occupied with the conditions for the existence of the second differential coefficients of the potential within an area carrying surface-density, and of the first differential coefficients of the potential on a curve carrying line-density. At a corner of the area in the first case, or of the curve in the second, the differential coefficients in question do not exist unless the axes of coordinates have certain special directions.—Alternative expressions for perpetuant types: P. W. **Wood.**—An informal communication on the theory of geodesics was made by Prof. **Forsyth.**

CAMBRIDGE.

Philosophical Society, February 27.—Mr. F. H. Neville in the chair.—Soluble forms of metallic dihydroxytartrates: H. J. H. **Fenton,** F.R.S. Sodium dihydroxytartrate is remarkable for its very sparing solubility in water, and it has previously been shown by the author that this property may be made use of for the qualitative and quantitative estimation of sodium. When equivalent quantities of dihydroxytartaric acid and sodium ethylate are mixed in alcoholic solution a semi-transparent gelatinous precipitate is obtained which is altogether unlike the salt above mentioned and is extremely easily soluble in water. Its aqueous solution after standing for a few minutes deposits a white, crystalline precipitate of the sodium salt in its ordinary hydrated form. The calcium salt shows a similar behaviour, and it would appear that the ordinary metallic dihydroxytartrates must be regarded as derivatives of a hydrated form of the acid $C_4H_6O_8$.—Studies on unsaturated ketonic compounds: S. **Ruhemann.** The author has continued his researches on the combination of mercaptans with unsaturated ketones (see *Trans.* Chem Soc., 1905, lxxxvii., 17). In the light of previous researches, an explanation is given of the catalytic action of organic bases in the formation of additive products of mercaptans with unsaturated ketonic compounds.—Some compounds of guanidine with sugars: R. S. **Morrell** and A. E. **Bellars.** The addition of guanidine to a solution of any sugar in absolute alcohol causes a precipitate of an addition product of the sugar and the base. The compounds are only slightly hydrolysed in aqueous solution, but they are easily decomposed by acids. Their optical properties are peculiar; in some cases the rotation angle is opposite in sign to that of the parent sugar, in others there is a marked multi-rotation.—The influence of strong electromagnetic fields on the spark spectra of some metals: J. E. **Purvis.** The electromagnet is an exceptionally strong one. The pole pieces are conical, and the strength of the field between the two poles with a current of 25 amperes is 40,000 C.G.S. units. It was placed in such a position that a line joining the poles was perpendicular to a line drawn from the slit to the grating. The metals of which an account is given are gold, bismuth, antimony, lead, and tin. The results so far show that amongst the various lines a considerable number are divided into triplets; whilst, of those which do not show any division, some seem to be widened when the spark is in the field. By analysing the divided lines by means of a calcite crystal, the components do not seem to be polarised in the same way; *i.e.* the outside components of one triplet are vibrating perpendicular to the lines of force, whilst those of another are parallel to the lines of force, and the same applies to the inner component. Some lines appear as doublets; but in many cases most probably the doublets are reversals, and these phenomena are particularly marked amongst the lines of antimony and bismuth. It will be necessary to study these with the magnet placed "end on." Two lines may be very close together, one stronger than the other, and the stronger line will be divided into three, whilst the weaker one is slightly widened only. The work is still in progress, and with other metals.

PARIS.

Academy of Sciences, March 6.—M. Troost in the chair.—The president read a telegram from Dr. Jean Charcot concerning the work of the Antarctic Expedition.—On the orthogonal trajectories of a family of surfaces: Gaston **Darboux.**—A rational formula for the coefficient of absorption of light by a translucent body: J. **Boussinesq.**—The study of 1-methyl-4-benzylcyclohexanol and 1-methyl-4-dibenzylcyclohexanol: A. **Haller** and F. **March.** Methylcyclohexanone reacts with sodium derivatives of alcohols in a manner resembling camphor, the sodium derivative of benzyl alcohol giving a mixture of methyl-benzyl- and methyl-dibenzyl-hexanol, separable by fractional distillation in a vacuum.—*Eumedon convictor,* a crustacean accompanying a sea-urchin: E. L. **Bouvier** and G. **Seurat.** The Eumedon occupies a pouch near the anal region of the sea-urchin, and is well protected by the long spines of the latter. The crustacean is not parasitic on its host, the relations between the two closely resembling those holding between *Pionodesmotes phormosoae* and the sea-urchin *Phormosoma uranus.*—On the constitution of sun-spots: Th. **Moreux.** A discussion of the penumbra of the large sun-spot of January, 1904, of which a drawing is given. The second penumbra, attributed by some observers to irregularities in the nucleus of the spot, is clearly shown, and the author regards this as an additional proof of the theory advanced by him in June, 1900.—On sliding friction: L. **Lecornu.** The author considers that the law of Coulomb cannot be regarded as rigorously true, but is rather an empirical rule only roughly approximate.—The oscillations of railway carriages on their springs: Georges **Marié.** The author has deduced a relation between the periodic variations in level of the permanent way, the friction of the spring, and the deflection of the spring, and has applied this experimentally to various classes of rolling stock. As a rule, the condition of convergence was realised, but there were a few faulty vehicles in which this was not the case.—On the determination by the chronometer of differences of latitude at Madagascar and Réunion: M. **Driencourt.** The data given have a probable accuracy of 0·1 sec. This precision is rarely attained in such measurements, and details of the working methods are given.—On the determination of gaseous densities and the accuracy possible in such measurements: A. **Leduc.** For the more permanent gases the author regards the possible accuracy in the density as about 1 in 10,000; for the more easily condensable gases the probable accuracy is lower. The results recently published by MM. Moissan and Chavanne, Moissan and Binet du Jassoneix, Guye and Pintza, and Jacquerod and Pintza are criticised.—The action of radium bromide on the electrical resistance of metals: Bronislas **Sabat.** Bromide of radium, placed near wires of bismuth, iron, steel, copper, platinum, brass and German silver, increases their electrical resistance. This effect cannot be wholly attributed to the rise of temperature caused by the radium salt.—Contribution to the study of ionisation in flames: Pierre **Massoulier.** Previous experimenters have employed electrodes placed one above the other in the flame, and the dissymmetry thus necessarily introduced partially masks the results. The author employs vertical electrodes placed symmetrically in the flame, and the reversal of the field is then without effect on the course of the phenomena. Curves are given showing the relation between the distances from the electrodes and the fall of potential.—The variations of the equivalent spark of an X-ray tube: S. **Turchini.**—On the time that appears before precipitation appears in solutions of hyposulphites: Gaston **Gaillard.**—On the electrolytic solution of platinum in sulphuric acid: André **Brochet** and Joseph **Petit.** Platinum is dissolved in sulphuric acid under the action of a variable current, and the action of the alternating current is not specially due to the change in the sense of the current. In the presence of an oxidising agent the solution of the platinum is impeded.—A comparison of the physical properties of pure nickel and cobalt: H. **Copaux.** Nickel and cobalt have been obtained practically free from other metals, and containing only one or two thousandths of non-metallic impurities. They are magnetic, very crystalline metals, not malleable in the cold. They differ in appearance, cobalt being bright, resembling silver, whilst nickel is dull. Determinations of the density, hardness,

melting point, electrical resistance, and breaking load are given.—The action of potassium permanganate on salts of hydroxylamine: L. J. **Simon.** A study of the oxidation of the nitrate, phosphate, and arsenate of hydroxylamine.—On quadrivalent oxygen: E. E. **Blaise.** The author has succeeded in obtaining a zinc compound,

$$(C_2H_5)_2.O.(I).Zn.(I).O.(C_2H_5)_2,$$

crystallising in fine prisms, and corresponding in composition to the magnesium compound previously described. The bearing of this compound on the theory of quadrivalent oxygen is discussed.—On the decomposition of orthonitrobenzyl alcohol under the influence of aqueous and alcoholic soda: P. **Carré.**—On the comparative assimilability of ammonia salts, amines, amides, and nitriles: L. **Lutz.** Experiments with Aspergillus and Penicillium show that of all nitrogenous compounds amides are the most easily assimilated; ammonia salts come next, then amines and nitriles.—The distribution of estragol and terpene compounds between the various parts of an annual plant: Eug. **Charabot** and G. **Laloue.**—On the so-called physicochemical analysis of arable earth: H. **Lagatu.** A description of a graphical mode of representing the analysis into three proximate constituents of an arable earth.—On some facts relating to the development of the kidney in Elasmobranchs: I. **Borcea.** A detailed study, illustrated with four diagrams, of the development of the renal system of *Acanthias vulgaris*.—On a form of scales peculiar to the Pandalidæ: H. **Coutière.**—On some anomalous forms of amitosis in the epithelium of mammals: M. **Pacaut.**—On some diseases of the tobacco plant: Georges **Delacroix.**—An experimental study of the conditions which determine the penetration of the vapours of chloroform into the blood during chloroformic anæsthesia, and on the influence of the variations of the pulmonary ventilation on this penetration: J. **Tissot.** It is shown that, contrary to the view generally accepted, during anæsthesia with mixtures containing between 7 and 12 per cent. of chloroform there is no possibility of establishing an equilibrium between the blood and the mixture, since this equilibrium would correspond to a fatal dose of chloroform. The variable equilibrium which is actually produced depends largely on the pulmonary ventilation.—On the secreting power of the kidney: Henri **Lamy** and André **Mayer.**—The spectroscopic study of oxyhæmoglobin: M. **Piettre** and A. **Vila.**—The action of ammoniacal salts on the nitrification of sodium nitrite by the nitric ferment: E. **Boullanger** and L. **Massol.**—On the distemper of dogs: H. **Carré.**—On a geological section of the High Atlas in the region of Glaoui, Morocco: Paul **Lemoine.**—Examination of the fossils brought from the Yunnan by the Lantenois expedition: H. **Mansuy.** The study of these fossils confirms the analogies previously recognised between the primary and secondary fauna of the Indo-Chinese region and the synchronic fauna of India and Central Asia.—The Bishop's circle of Mt. Pelée, Martinique: F. A. **Forel.**

DIARY OF SOCIETIES.

THURSDAY, MARCH 16.

ROYAL SOCIETY, at 4.30.—A New Radio-active Element, which evolves Thorium Emanation. Preliminary Communication: Dr. O. Hahn.—A Determination of the Amounts of Neon and Helium in Atmospheric Air: Sir William Ramsay, K.C.B., F.R.S.—A Preliminary Note upon the Question of the Nutrition of the Early Embryo: E. Emrys-Roberts.—On the Absence or Marked Diminution of Free Hydrochloric Acid in the Gastric Contents, in Malignant Disease of Organs other than the Stomach: Prof. B. Moore (with W. Alexander, R. E. Kelly, and H. E. Roaf).—On the Occurrence of certain Ciliated Infusoria within the Eggs of a Rotifer, considered from the Point of View of Heterogenesis: Dr. H. C. Bastian, F.R.S.—On the Dimorphism of the English Species of Nummulites, and the Size of the Megalosphere in Relation to that of the Microspheric and Megalospheric Tests in this Genus: J. J. Lister, F.R.S.—Observations on the Brains of Man and Animals with Trypanosome Infection. Preliminary Note: Dr. F. W. Mott, F.R.S.

ROYAL INSTITUTION, at 5.—Recent Astronomical Progress: Prof. H. H. Turner, F.R.S.

SOCIETY OF ARTS, at 4.30.—Manipur and its Tribes: T. C. Hodson.

LINNEAN SOCIETY, at 8.—Contributions to the Flora of Liberia: Dr. Otto Stapf.—*Exhibitions:* Penguins and other Birds from the Falkland Islands, and Scratched Rocks from a Rockhopper's Rookery: R. Vallentin.

FRIDAY, MARCH 17.

EPIDEMIOLOGICAL SOCIETY, at 8.30.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—First Report to the Steam-Engine Research Committee: Prof. David S. Capper.

SATURDAY, MARCH 18.

ROYAL INSTITUTION, at 3.—Electrical Properties of Radio-active Substances: Prof. J. J. Thomson, F.R.S.

MONDAY, MARCH 20.

SOCIETY OF ARTS, at 8.—Telephony: H. L. Webb.

VICTORIA INSTITUTE, at 4.30.—The Nebular and Planetesimal Theories of the Earth's Origin: Warren Upham.

TUESDAY, MARCH 21.

ROYAL INSTITUTION, at 5.—Engineering Problems: Prof. W. E. Dalby.

ROYAL STATISTICAL SOCIETY, at 5.

ZOOLOGICAL SOCIETY, at 8.30.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Discussion:* Shipbuilding for the Navy: Lord Brassey, K.C.B.—*Paper:* Coolgardie Water-Supply: C. S. R. Palmer.

WEDNESDAY, MARCH 22.

GEOLOGICAL SOCIETY, at 8.—An Experiment in Mountain-Building Part II.: Lord Avebury, P.C., F.R.S.—The Rhætic Rocks of Monmouthshire: L. Richardson.

SOCIETY OF DYERS AND COLOURISTS, at 7.30.—The Dyeing and Finishing of Leather for Bookbinding; with remarks on Preparatory Manufacturing Processes: F. W. Colin Robinson.—A Dyeing Drum Door, removable and replaceable without stopping the Drum: H. W. Ley.

THURSDAY, MARCH 23.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: The Reception and Utilisation of Energy by the Green Leaf: Dr. Horace T. Brown, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Report of Experiments carried out at the National Physical Laboratory: On the Effect of Heat on the Electrical and Mechanical Properties of Dielectrics, and on the Temperature Distribution in the Interior of Field Coils: E. H. Rayner.—*Discussion:* On Temperature Curves and the Rating of Electrical Machinery: R. Goldschmidt.

ROYAL INSTITUTION, at 5.—The Reasonableness of Architecture: Thomas G. Jackson.

FRIDAY, MARCH 24.

ROYAL INSTITUTION, at 9.—A Pertinacious Current: Sir Oliver Lodge, F.R.S.

PHYSICAL SOCIETY, at 5.—Note on the Voltage Ratios of an Inverted Rotary Converter: W. C. Clinton.—On the Flux of Light from the Electric Arc with varying Power Supply: G. B. Dyke.—The Application of the Cymometer and the Determination of the Coefficient of Coupling of Oscillation Transformers: Prof. J. A. Fleming, F.R.S.—Exhibition of Cymometers and other Instruments.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Wanki to Victoria Falls Section; Victoria Falls Railway: C. T. Gardner.—Design of a Double-Line Plate-Girder Railway-Bridge: H. S. Coppock.

SATURDAY, MARCH 25.

ROYAL INSTITUTION, at 3.—Electrical Properties of Radio-active Substances: Prof. J. J. Thomson, F.R.S.

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